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09/534,503	03/24/2000	Koji Tanizawa	AOY.003	2431

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EXAMINER

BAUMEISTER, BRADLEY W

ART UNIT

PAPER NUMBER

2815

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Please find below and/or attached an Office communication concerning this application or proceeding.

NP

Office Action Summary	Application No. 09/534,503	Applicant(s) Tanizawa
	Examiner Bradley Baumeister	Art Unit 2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on Nov 13, 2001

2a) This action is FINAL. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) Claim(s) 1-34 is/are pending in the application.

4a) Of the above, claim(s) 11-20 is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 1-10 and 21-34 is/are rejected.

7) Claim(s) _____ is/are objected to.

8) Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on _____ is/are objected to by the Examiner.

11) The proposed drawing correction filed on _____ is: a) approved b) disapproved.

12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13) Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a) All b) Some* c) None of:

1. Certified copies of the priority documents have been received.
2. Certified copies of the priority documents have been received in Application No. _____.
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) Notice of References Cited (PTO-892) 18) Interview Summary (PTO-413) Paper No(s). _____

16) Notice of Draftsperson's Patent Drawing Review (PTO-948) 19) Notice of Informal Patent Application (PTO-152)

17) Information Disclosure Statement(s) (PTO-1449) Paper No(s). 2 20) Other: _____

DETAILED ACTION

Priority

1. Acknowledgment is made of applicant's claim for foreign priority based on applications filed in Japan on 3/29/99, 4/1/99, 4/5/99, 4/21/99 and 9/8/99. It is noted, however, that applicant has not filed a certified copy of any of the foreign applications as required by 35 U.S.C. 119(b).

Election/Restriction

2. In the restriction of Paper #3, dated 8/27/2001, the Examiner set forth the following restriction requirement:

SPECIES I: a III-N device wherein a single-layered p-type layer is formed between the active layer and the low-doped p-type layer, to which at least claims 11-20 are directed.

SPECIES II: a III-N device wherein a multi-layered p-type layer is formed between the active layer and the low-doped p-type layer, to which at least claims 1-10 are directed.

3. Applicant elected without traverse Species II in Paper No. 4 and 6. In the election response of paper #6, Applicants confirmed that claims 1-10 read on the elected species and stated that Applicants consider the subject matter of Claim 21 to constitute a separate species.

a. Subsequent to this election, the Examiner held a telephone interview with Applicants' Representative, Mr. Adam Volentine on 1/22/02 to discuss the restriction requirement and to better understand why Applicants consider claims 21 (and its dependent

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claims) to constitute a separate species. Mr. Volentine explained that claims 21-34 are directed towards a III-N device wherein the low-doped p-type layer has a graded impurity concentration profile. The examiner does not consider the language relating to the graded impurity concentration appearing in claim 21 to cause these claims to constitute a separate species. In order to constitute a separate species, the claims of the different species must possess some mutually exclusive feature (See MPEP 806.04(f)). However, this is not so in the present case.

b. The specification explains that a graded impurity profile results from the diffusion of dopants from the clad and contact layers into the low-doped p-type layer (see e.g., specification page 51, first paragraph). This will occur regardless of whether the first p-type layer is a single-layer or a multilayer structure. In fact, both of Species I and II include dependent claims which set forth language relating to this phenomenon (see claims 4 and 14).

c. Thus, this language of claim 21 does not cause it to be directed towards a separate invention. Further, claim 21 generically sets forth a first p-type layer, common to both the single-layered p-type layer (Species I) and the multi-layered p-type layer (Species II). Also, dependent claims 27, 30 and 31 set forth limitations relating to the multi-layered p-type layer.

d. Accordingly:

- i. Claims 1-10, 27, 30 and 31 are directed towards elected Species II;
- ii. Claims 11-20 are directed towards non-elected Species I;
- iii. Claims 21-26, 28, 29 and 32-34 are generic.

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Specification

4. The disclosure is objected to because of the following informalities: the specifications possesses various translational and idiomatic errors. For example:

- a. Page 11, line 24: “undope [sic: undoped] layer”
- b. “Reduced resistibility” is presumed to intend to read “reduced resistance.” (e.g. Page 39, line 21; page 41, line 8; page 42, line 14)
- c. Various portions set forth “An another”: page 67, line 22; p. 68, l. 18; p. 69, l. 14; p. 70, l. 10; ... (and every page at least through)... page 82, line 23.
- d. Page 76, line 7: “Two kind [sic: kinds] of another LED devices [sic: device] are manufactured...”

5. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting these and any other errors in the specification of which applicant may become aware.

Claim Objections

6. Claim 25 is objected to because of the following informalities: it recites, “said p-type low-doped layer are [sic: is] formed...” Appropriate correction is required.

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Claim Rejections - 35 USC § 112

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. Claims 30, 31 and 34 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

- a. Claim 30 recites the limitation "said p-type multi-film layer" in line 25. There is insufficient antecedent basis for this limitation in the claim.
- b. Claim 31 depends from claim 30.
- c. Claim 34 twice recites the limitation "said n-type first multi-film layer" in lines 22 and 24. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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10. Claims 1-7 and 21-31 are rejected under 35 U.S.C. 102(b) as being anticipated by JP 11-031841 (supplied by Applicants in IDS paper #2). JP '841 discloses III-N semiconductor light emitters comprising a sapphire substrate 1; undoped GaN buffer 2; n-side contact/clad 3; InGaN active layer 4 (see claim 24); a first p-type layer 5; a second, low-doped layer 6; and a third highly doped p-contact layer 7, doped higher than the first p-type layer (see e.g., [Means for Solving the Problem] as well as other sections for examples of relative doping levels).

a. Regarding claims 1, 26 and 27, the first p-type layer may be composed of AlGaN [0007] or of an (Al)GaN multilayer superlattice having at least one layer doped [0010].

b. Claims 2, 3, 29 and 30 set forth that the p-type low-doped layer has an Al content of $0 < x < 0.5$; and claim 28 sets forth the p-type low-doped layer is made of GaN. The reference gives examples of the respective layers' compositions as being $Al_xGa_{1-x}As$ ($0 \leq x \leq 1$) for first p-layer 5 ([0007], [0010]); and GaN (Al = 0) for the second (low) and third (contact) layers 6, 7 [0007]. However, the reference is not so limited. Rather, it also states that it is preferable for the second and third layers to have the same composition [0011], and that it is preferable for the third layer to have an Al content of 0.3 or less [0012].

c. Regarding claims 3, 25, 30 and 31, the reference states that the second layer may be composed of a multilayer superlattice [0011]. In further regard to claim 31, this disclosure in conjunction with the previously mentioned statement that the composition for the second layer has an Al content of 0 - 0.3 implies that the superlattice may be composed of GaAs/AlGaAs.

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d. Regarding claims 4, 21 and 22, the reference appears to state that the second layer is slightly doped by diffusion from the adjacent first and third layers [0008]. However, even if a translation that is more accurate than the present JPO machine-translation indicates that the reference is silent with respect to diffusion doping from adjacent layers, the claims would nonetheless be anticipated by the inherency doctrine. When III-N layers of dissimilar doping levels are formed and annealed in the manner set forth in this reference, atomic physics and chemistry principles dictate that some diffusion from the highly-doped layers to the adjacent low-doped layer will necessarily occur.

e. Regarding the specific doping levels set forth in claims 5-7, 21 and 23, see paragraphs [0010]--[0012].

11. Claims 1-7 and 21-31 are rejected under 35 U.S.C. 102(b) as being anticipated by JP 11-068155 (supplied by Applicants in IDS paper #2). JP '155 discloses III-N semiconductor light emitters which are substantially similar to those disclosed in JP '841. The primary difference is that JP '155 additionally discloses that the impurity profile in the low-doped p-type layer 6 may be intentionally graded on the side of the first p-layer 5 ([0008] and FIG 2).

a. Specifically, the device comprises a sapphire substrate 1; undoped GaN buffer 2; n-side contact/clad 3; InGaN active layer 4 (see claim 24); a first p-type layer 5; a second, low-doped layer 6; and a third highly doped p-contact layer 7, doped higher than the first p-type layer

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(see e.g., [Means for Solving the Problem] as well as other sections for examples of relative doping levels).

b. Regarding claims 1, 26 and 27, the first p-type layer may be composed of AlGaN [0008] or of an (Al)GaN multilayer superlattice having at least one layer doped [0012].

c. Claims 2, 3, 29 and 30 set forth that the p-type low-doped layer has an Al content of $0 < x < 0.5$; and claim 28 sets forth the p-type low-doped layer is made of GaN. The reference gives examples of the respective layers' compositions as being $Al_xGa_{1-x}As$ ($0 \leq x \leq 1$) for first p-layer 5 ([0008], [0012]); and GaN (Al = 0) for the second (low) and third (contact) layers 6, 7 [0008]. However, the reference is not so limited. Rather, it also states that it is preferable for the second and third layers to have the same composition [0013], and that it is preferable for the third layer to have an Al content of 0.3 or less [0014].

d. Regarding claims 3, 25, 30 and 31, the reference states that the second layer may be composed of a multilayer superlattice [0013]. In further regard to claim 31, this disclosure in conjunction with the previously mentioned statement that the composition for the second layer has an Al content of 0 - 0.3 implies that the superlattice may be composed of GaAs/AlGaAs.

e. Regarding claims 4, 21 and 22, the reference states that the low-doped layer has a graded impurity profile [0010]. Additionally, regardless of whether the reference discusses the additional doping gradients resulting from diffusion out of the adjacent first and third layers into the second layer, this phenomenon would necessarily occur as was explained above.

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f. Regarding the specific doping levels set forth in claims 5-7, 21 and 23, see paragraphs [0012]--[0014].

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

13. Claims 8-10 and 31-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 11-031841 as applied to the claims above.

a. Claim 31--setting forth that the low-doped layer possesses an AlGaN ($0 < \text{Al} < 0.5$) / GaN superlattice--was rejected as being anticipated (see above). In the alternative, assuming *arguendo* that the reference's teachings (that the second layer may be composed of a multilayer superlattice and that the composition for the second layer has an Al content of 0 - 0.3) must be interpreted so narrowly as not at least implying that the superlattice may be specifically composed of GaAs/AlGaAs, it nonetheless would have been obvious to one of ordinary skill in the art at the time of the invention to form the superlattice of these two materials because such a composition would produce a layer with an effective bandgap of the stated range, particularly at

effective band-gaps approaching that of GaN. Also, the use of these specific materials would not lead to any unexpected results.

b. Regarding claims 8-10 and 32-34, the reference discloses at least all of the claim limitations relating to the active and p-type layers, but it is not perfectly clear from the machine translation whether the reference also anticipates the limitations of these claims relating to the n-type structure. Specifically, in the embodiment of FIG 1, the n-contact/clad region 3 is formed on an undoped GaN buffer 2 and sapphire substrate 1, but does not additionally depict an undoped-doped-undoped n-region multilayer film. The embodiment of the emitter in FIG 2 employs an n-side strained superlattice clad layer 12 composed of multiple periods of n-AlGaN / undoped-GaN [0026]. In that multiple periods (100 layers) are disclosed, at least one of the n-AlGaN layers will be interposed between two undoped GaN layers.

It is unclear from the machine translation whether the reference expressly discloses that this alternately-doped superlattice clad may also be employed for the n-clad portion of the n contact/clad layer 3 in the embodiment of FIG 1. However, even assuming *arguendo* that the reference does not expressly disclose as much, it nonetheless would have been obvious to one of ordinary skill in the art at the time of the invention to have employed the superlattice clad of FIG 2 in the embodiment of FIG 1 for the purpose of obtaining a greater degree of design freedom relating to band-gap engineering and lattice-constant matching which is afforded by the superlattice clad.

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14. Claims 8-10 and 31-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 11-058155 as applied to the claims above.

a. Claim 31--setting forth that the low-doped layer possesses an AlGaN ($0 < \text{Al} < 0.5$) / GaN superlattice--was rejected as being anticipated (see above). In the alternative, assuming *arguendo* that the reference's teachings (that the second layer may be composed of a multilayer superlattice and that the composition for the second layer has an Al content of 0 - 0.3) must be interpreted so narrowly as not at least implying that the superlattice may be specifically composed of GaAs/AlGaAs, it nonetheless would have been obvious to one of ordinary skill in the art at the time of the invention to form the superlattice of these two materials because such a composition would produce a layer with an effective bandgap of the stated range, particularly at effective band-gaps approaching that of GaN. Also, the use of these specific materials would not lead to any unexpected results.

b. Regarding claims 8-10 and 32-34, the reference discloses at least all of the claim limitations relating to the active and p-type layers, but it is not perfectly clear from the machine translation whether the reference also anticipates the limitations of these claims relating to the n-type structure. Specifically, in the embodiment of FIG 1, the n-contact/clad region 3 is formed on an undoped GaN buffer 2 and sapphire substrate 1, but does not additionally depict an undoped-doped-undoped n-region multilayer film. The embodiment of the emitter in FIG 3 employs an n-side strained superlattice clad layer 12 composed of multiple periods of n-AlGaN /

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undoped-GaN [0027]. In that multiple periods (100 layers) are disclosed, at least one of the n-AlGaN layers will be interposed between two undoped GaN layers.

It is unclear from the machine translation whether the reference expressly discloses that this alternately-doped superlattice clad may also be employed for the n-clad portion of the n contact/clad layer 3 in the embodiment of FIG 1. However, even assuming *arguendo* that the reference does not expressly disclose as much, it nonetheless would have been obvious to one of ordinary skill in the art at the time of the invention to have employed the superlattice clad of FIG 3 in the embodiment of FIG 1 for the purpose of obtaining a greater degree of design freedom relating to band-gap engineering and lattice-constant matching which is afforded by the superlattice clad.

Double Patenting

15. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

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16. Claims 1, 4-7, 21-23, 26 and 27 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 2, 4, 5 and 9 of U.S. Patent No. 6,337,493. Although the conflicting claims are not identical, they are not patentably distinct from each other because the claims are generally similar, both setting forth III-N light emitters having a substrate; n layer; active layer; a p-type layer; a low doped p-layer; and a p-type contact layer. Further the dependent claims set forth identical, specific doping levels. The differences being only obvious variations. Specifically:

a. The '493 claims are broader than the present claims in that the present claims sets forth that the active layer contains (In)GaN while the '493 claims do not set forth the active layer's composition (e.g., compare claim 1 of the present application and claim 2/1 of the '493 patent). Nonetheless, it was obvious to one of ordinary skill in the art at the time of the invention to employ (In)GaN for the active layer in (Al)GaN-based emitters because (In)GaN has a smaller bandgap and would therefore more effectively confine carriers therein for more efficient light emission.

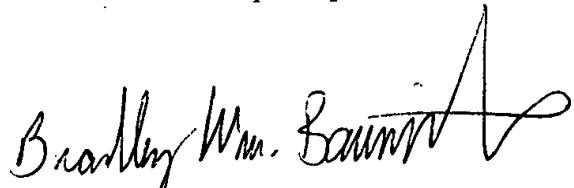
b. The '493 claims are narrower than the present claims in that the '493 claims additionally set forth a p-type high concentration doped layer interposed between the p-contact layer and the p-type low concentration layer (e.g., claim 2), which is not recited in the present claims. It would have been obvious to one of ordinary skill in the art at the time of the invention was made to delete the additional high-concentration doped layer from the device of the '493 claims since it has been held that the omission of an element and its function in a combination

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where the remaining elements perform the same function as before involves only routine skill in the art. *In re Karlson*, 136 USPQ 184.

INFORMATION ON HOW TO CONTACT THE USPTO

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to the examiner, **B. William Baumeister**, at (703) 306-9165. The examiner can normally be reached Monday through Friday, 8:30 a.m. to 5:00 p.m. If the Examiner is not available, the Examiner's supervisor, Mr. Eddie Lee, can be reached at (703) 308-1690. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.



B. William Baumeister

Patent Examiner, Art Unit 2815

January 27, 2002